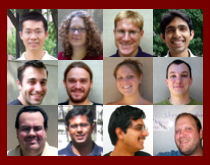
Visual Interfaces to Digital Libraries

Katy Börner & the InfoVis Lab
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BLOOMINGTON
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NII, Tokyo Japan
November 21st, 2005

Visual Interfaces to Digitial Libraries

The accelerating rate of scientific and technical discovery, typified by the ever-shortening time period for the doubling of information – currently estimated at 18 months – causes new topics to emerge at increasing speed. Libraries have a hard time just cataloguing the large amount of produced documents. Scientists and practitioners who must read and process relevant documents are in need of new tools that can help them to identify and manage this flood of information. Visual Interfaces to digital libraries apply powerful data analysis and information visualization techniques to generate visualizations of large document sets. The visualizations are intended to help humans mentally organize, electronically access, and manage large, complex information spaces and can be seen as a value-adding service to digital libraries. This talk motivates the design and usage of visual interfaces to digital libraries, reviews diverse commercially successful systems, and discusses opportunities and challenges.

Reference:

Börner, Katy and Chen, Chaomei (Eds.) (2002). *Visual Interfaces to Digital Libraries*. Springer Verlag, LNCS 2539.

Overview

1. Motivation
2. Visual Interfaces to Digital Libraries (DL)
   - Research Systems
   - Commercial Interfaces
3. Collaborative Information Visualization Environments
4. Top Ten List of Major Challenges

1. Limitations of Today's Interfaces to DL

Facing the Information Flood:

- Information available in electronic form doubles every 18 months.
- Human perception stays constant.

- Almost no development in online interfaces. Can't pack more text.

Let's see how much our means of accessing information have changed using http://www.archive.org/.

Yahoo

Oct 17, 1996

Yahoo

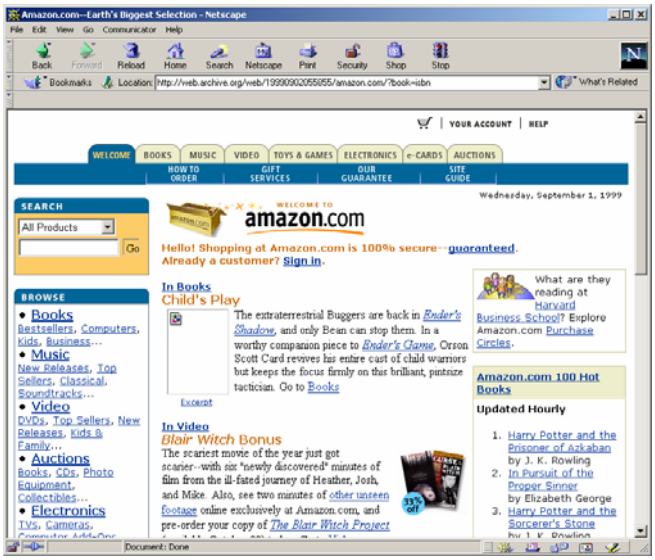
Sept 2, 2002

Yahoo

Nov 21st, 2005

Amazon

Sept 02, 1999



Amazon

Sept 2, 2002

Amazon

Nov 21st, 2005

Facing the Information Flood:

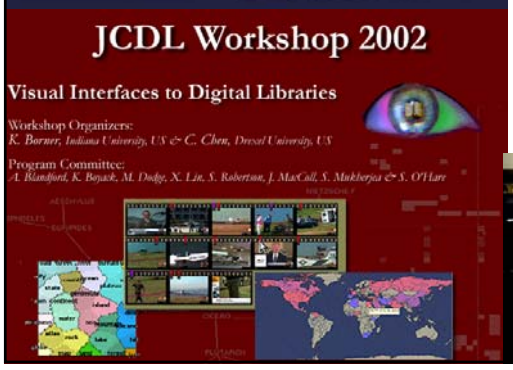
- Information available in electronic form doubles every 18 months.
- Human perception stays constant.

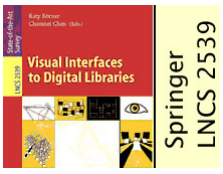
Opportunity & Challenge:

Shift user's mental load from slow reading to faster perceptual processes such as visual pattern recognition.

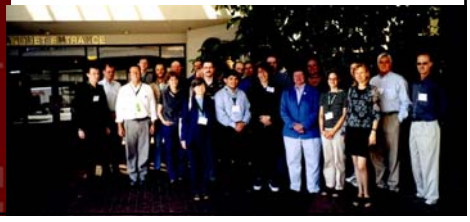
Facilitated by:

- CPU speed & hard disk sizes have increased by two orders of magnitude.
- Bandwidth: Since the invention of the web browser, international IP bandwidth deployments have more than doubled each year.
- Monitor resolution has increased by a factor of 4 (800x600 -> 1600x1200).



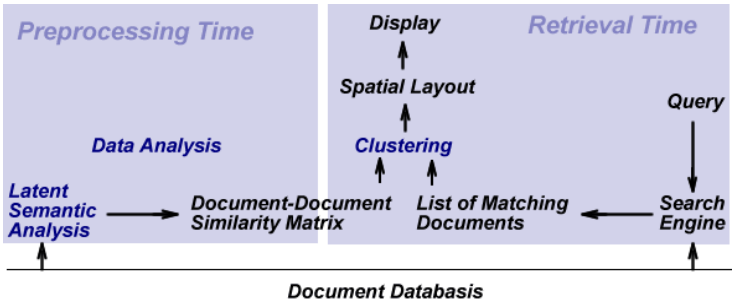


Katy Börner & Chaomei Chen (Eds): Visual Interfaces to Digital Libraries. Springer Verlag, LNCS 2539, 2002.

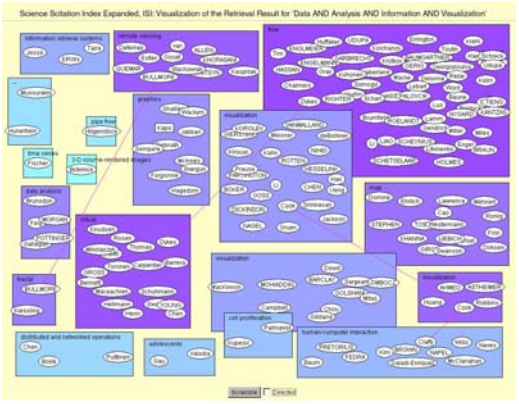


2. Visual Interfaces to Digital Libraries

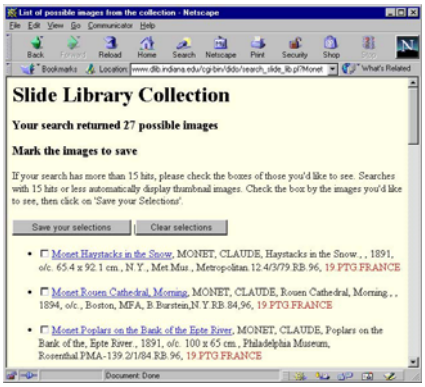
Present search results not as rank-ordered lists of matching documents but as clusters of semantically similar documents.

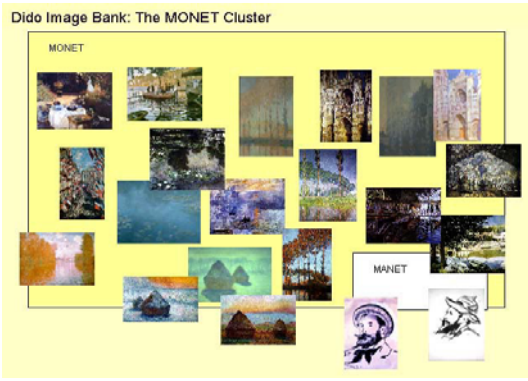


VisDL to ISI's Web of Science Interface



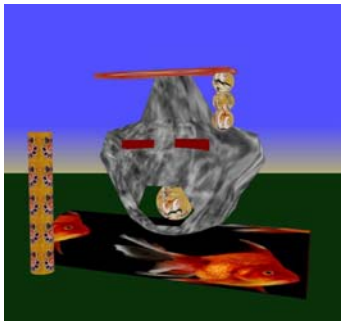
VisDL to IUB's Art Image Database

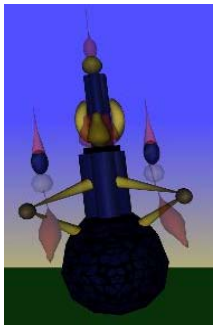




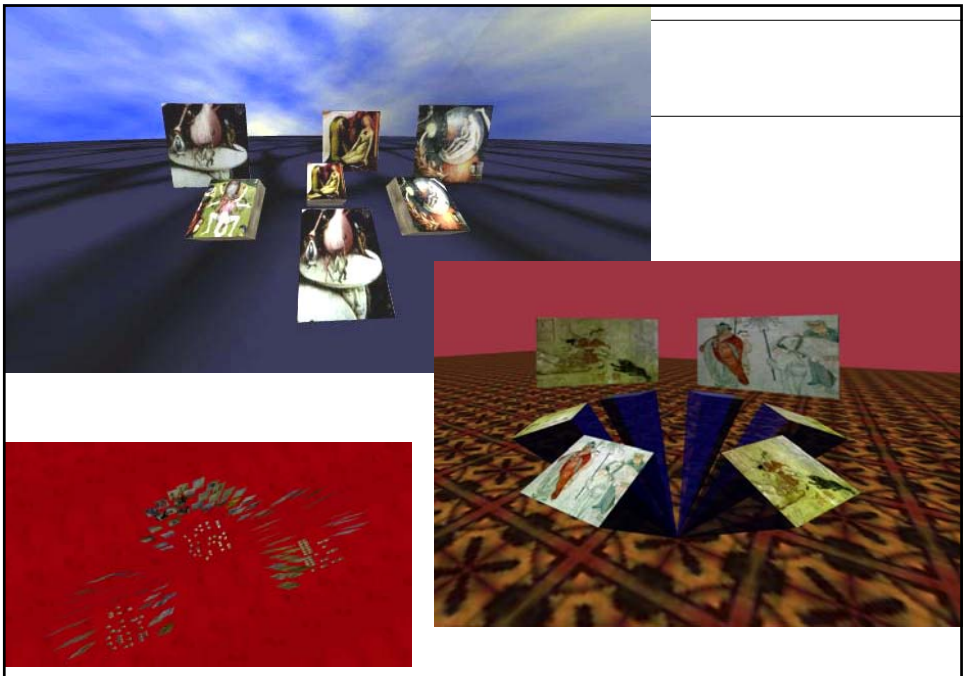
3-D VisDL to IUB's Art Image Database

"head" into a search result - "get inside a head"





Katy Börner: Visual Interfaces for Semantic Information Retrieval and Browsing. Vladimir Groimenko and Chaomei Chen (Eds.), *Visualizing the Semantic Web: XML-based Internet and Information Visualization*, Springer Verlag, Chapter 7, pp. 99-115, 2002.



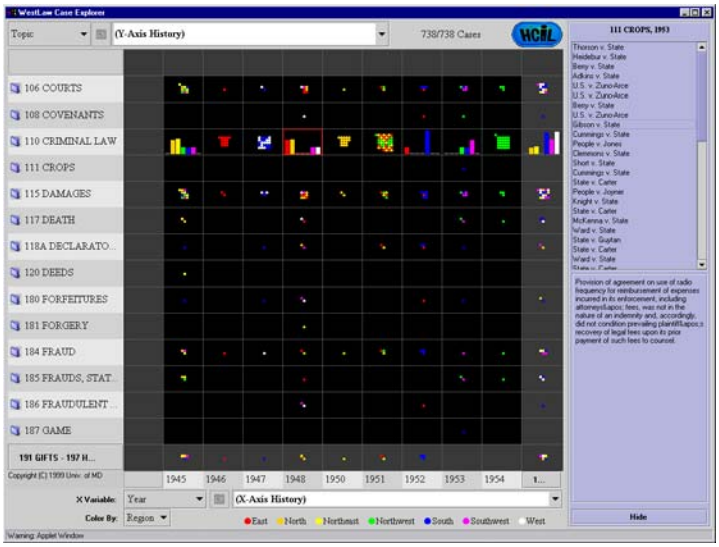
VisDL Usability Studies

- Comparison of text-based and 2-D desktop interface and 3-D immersive CAVE interface.
- Error rates and completion times for a range of different tasks.
- Steep learning curves for 2-D & 3D visualization & 3D input devices, 3D navigation.
- A comparison of free sorting results for images by human subjects and by Latent Semantic Analysis.

Katy Börner: Searching for the perfect match: A comparison of free sorting results for images by human subjects and by Latent Semantic Analysis, Information Visualisation 2000, Symposium on Digital Libraries, London, England, 19 -21 July, pp. 192-197, 2000.

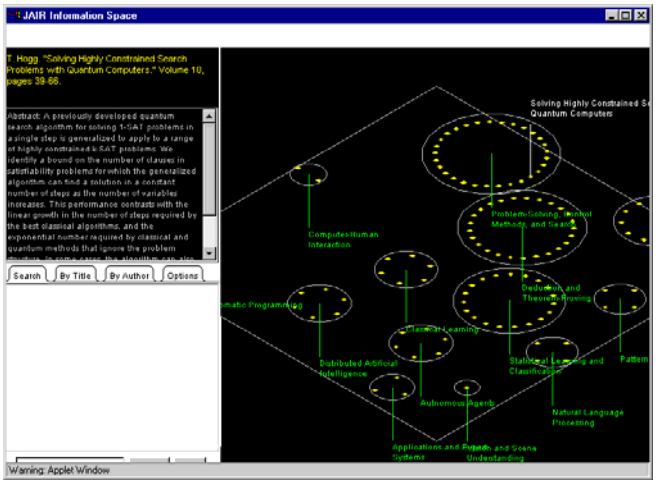
Other Research Systems not captured in the book

GRIDL
HCI Lab
U Maryland
applied to
court
cases



Jair Space (by Mark Foltz, MIT, 1995)

Designing Navigable Information Spaces
(Source: http://www.infoarch.ai.mit.edu/jair/)

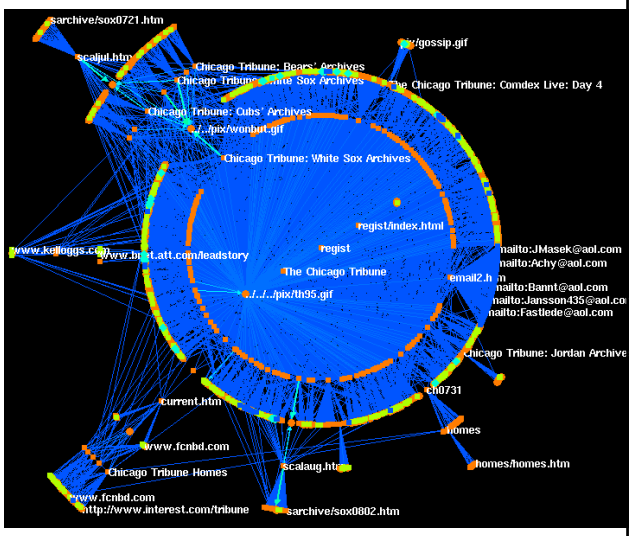


NicheWorks: The Chicago Tribune Website

By Graham Wills, Bell Labs (Lucent Technology).

A set of visualization tools for very large graphs. MOMspider plus layout algorithms for very large graphics.

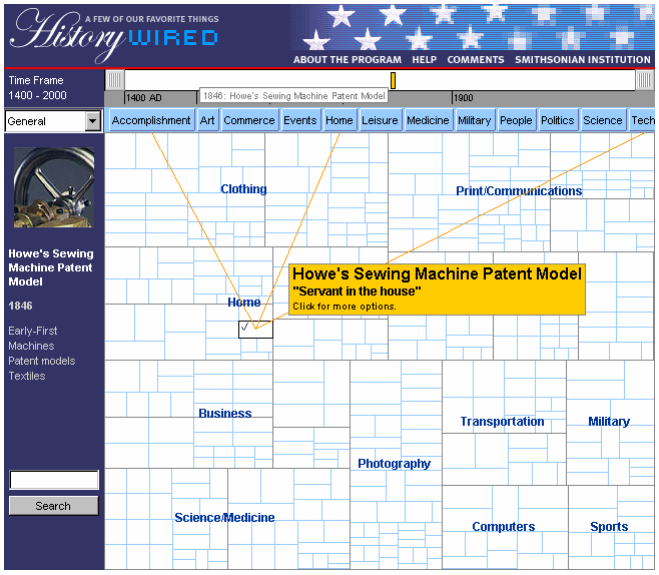
(Source: http://www.bell-labs.com/user/gwills/NICHEguide/nichepaper.html)



Smithsonian Institution's HistoryWired: A few of our favorite things. This experimental site introduces visitors to some of the three million objects held by the National Museum of American History, Behring Center.

http://historywired.si.edu/index.html

SmartMoney



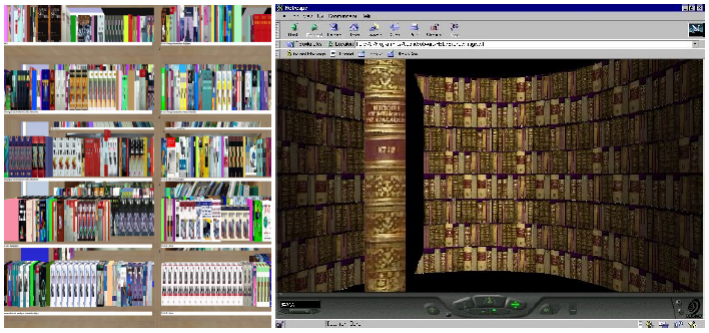
Spatial Worlds for Information Retrieval and Learning

Maps electronic card catalog searches in libraries can be projected into a virtual architectural world, where spatial qualities can provide orientation and increase intellectual productivity.

(Source: http://www.arch.columbia.edu/DDL/research/SWIRL/)

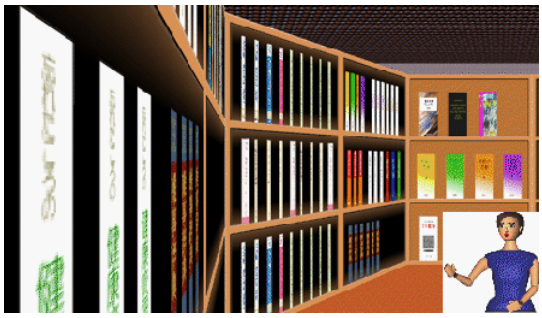
Visualisation pour les bibliothèques numériques

Numéro spécial de la revue « Document Numérique »
Coordinateurs de ce numéro :
Jean-Daniel Fekete (INRIA Futurs/LRI) & Eric Lecolinet (ENST)



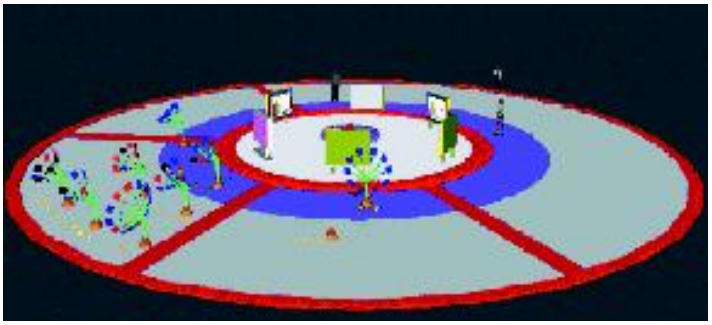
3-D DL interface

User interfaces for information strolling on a digital library
Mikiya Tani, Toshiyuki Kamiya, and Shunji Ichiyama, Kansai C&C Labs. NEC Corp.



(Source: http://www.cc.gatech.edu/gvu/people/Visitors/Mikiya.Tani/report/ISDL/)

Shared Knowledge Garden



(Source: Crossley et al., BT Laboratory, UK)

cospace was an experimental 3D shared environment for browsing the Web. In cospace Web surfers are represented as avatars and can communicate with each other. It was developed by Thomas Kirk and Peter Selfridge at AT&T Labs.

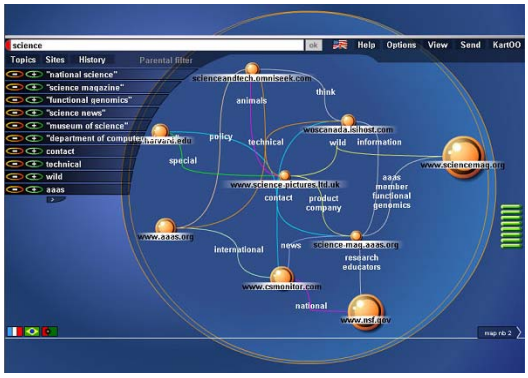
(Source: http://www.cybergeography.org/atlas/info_spaces.html)

Commercial Systems: Visual Interfaces for Search & Browsing

KartOO by Laurent and Nicolas Baleydier

Organizes search results retrieved from relevant web search engines by topics and displays them on a 2-dimensional map.

Each Web page is represented by a ball. Size of the ball corresponds ~ relevance to the query. Color-coded links suggest how the documents interrelate. Resting the mouse pointer over a "ball" causes a brief description of the contents to appear.



http://kartoo.com/

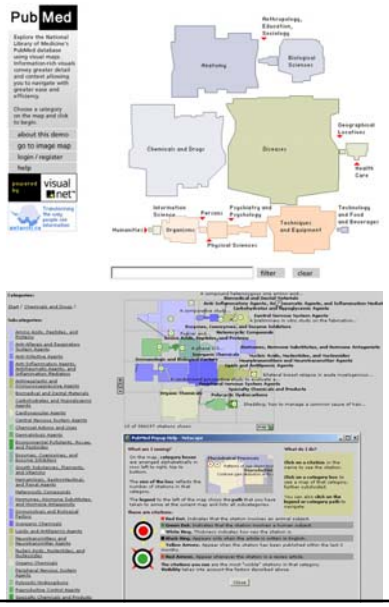
Antarcti.ca System Inc.'s Visual Net™ product

Provides visual interface to the National Library of Medicine's PubMed database, in particular the Anatomy/Body Regions section. Initial data map shows the top-level Medical Subject Headings (MeSH) categories arranged alphabetically in rows from left to right, top to bottom.

Users can click on an area of interest to zoom into the corresponding area, causing an enlarged version of the area to appear further subdivided into subcategories, if there are any. The subcategories are listed in the legend on the left, and labeled in bold on the map.

Alternatively, users can filter out documents of interest by entering a keyword in the search window. Matching documents will be marked on the map to facilitate visual browsing based on the Boolean search result.

http://pubmed.antarcti.ca/start



Katy Börner: Visual Interfaces to Digital Libraries, NII Talk, Tokyo, Japan, Nov 21th, 2005.

IVIRA

Information Visualization Interfaces for Retrieval and Analysis

at the Joint Conference on Digital Libraries 2003

Saturday, 31 May 2003 from 9am - 12:30pm and 2pm - 5:30pm

The Workshop is open to anybody registered at JCDL.

Organizers | Expected Audience | Description | Objectives | Submission Selection | Planned Publication | Program Committee

Organizers

Javed Mostafa
Information Science & Informatics
Indiana University
Bloomington, IN 47405, USA
jm@indiana.edu

Katy Börner
School of Library and Information Science
Indiana University
Bloomington, IN 47405, USA
katy@indiana.edu

Börner, Katy & Mostafa, Javed (March 2005) *International Journal on Digital Libraries*. Special Issue on Information Visualization Interfaces for Retrieval and Analysis. Springer-Verlag, 5(1).

Figure 1. The Task Gallery.

(Source: Microsoft http://research.microsoft.com/ui/TaskGallery/)

Figure 6. Start Palette - A Data Mountain held in the user's left-hand toolspace.

3. Collaborative Information Visualization Environments

Memory Palaces

Provide intuitive, efficient, and collaborative document access for a scholarly community.

Mirror Gardens

Visualize user interaction data to evaluate the effectiveness and usability, to optimize design properties, or to examine the evolving user community of a world.

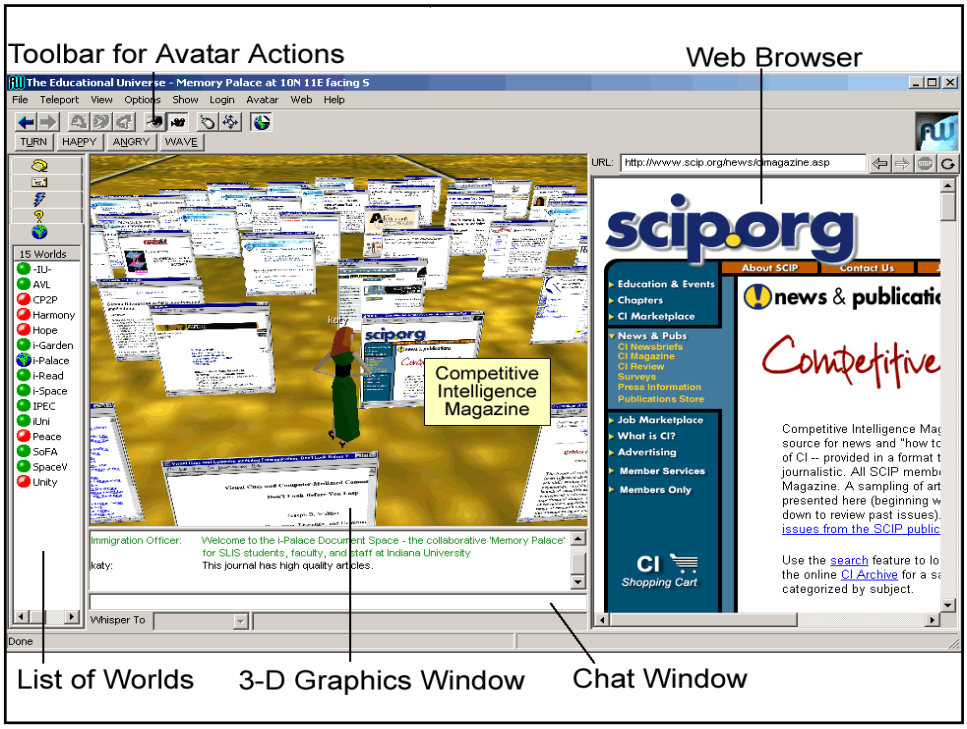
Katy Börner: Twin Worlds: Augmenting, Evaluating, and Studying Three-Dimensional Digital Cities and Their Evolving Communities. In Makoto Tanabe, Peter van den Besselaar, and Toru Ishida (eds), *Digital Cities II: Computational and Sociological Approaches*, Springer Verlag, LNCS 2362, pp. 256-269, 2002.

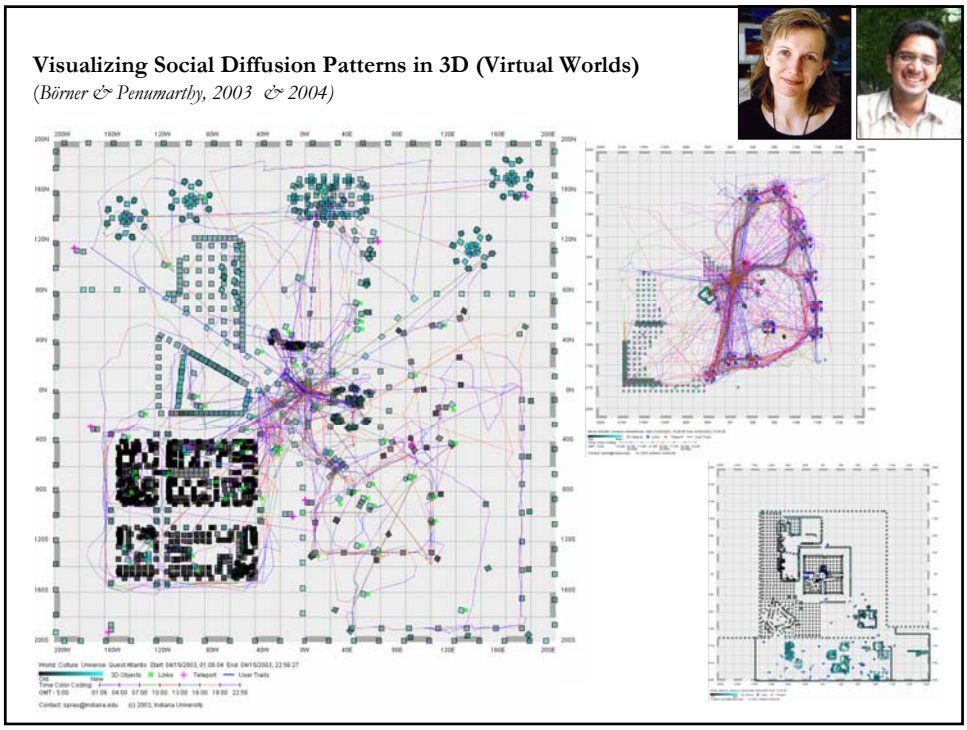
Indiana University's Collaborative Information Universe

This project is a collaboration between the School of Library and Information Science and UITS' Advanced Visualization Laboratory.

The project's goal is to provide a 3D web-based collaboration mechanism for all IU faculty, staff and students on any of the eight IU campuses, located throughout the state of Indiana.

http://iuni.slis.indiana.edu/

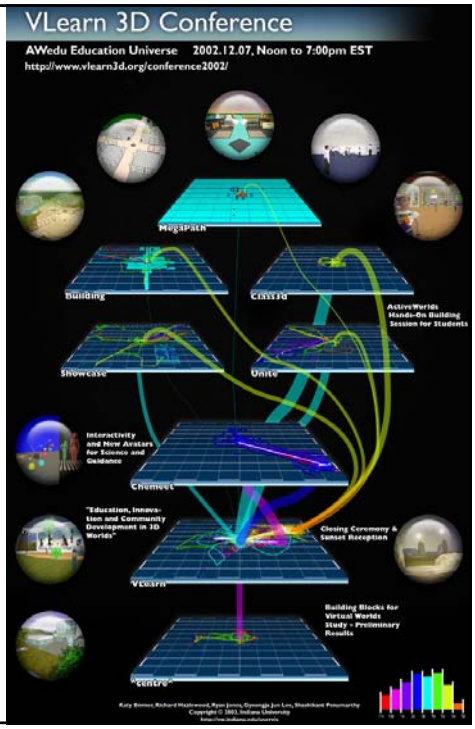

Toolbar for Avatar Actions
Web Browser
The Educational Universe - Memory Palace at 10N 11E facing S
File Teleport View Options Show Login Avatar Web Help
TURN HAPPY ANGRY WAVE
15 Worlds
-IU-
AVL
CP2P
Harmony
Hope
i-Garden
i-Palace
i-Read
i-Space
IPEC
iUni
Peace
SoFA
SpaceV
Unity
Competitive Intelligence Magazine
Immigration Officer: Welcome to the i-Palace Document Space - the collaborative 'Memory Palace' for SLIS students, faculty, and staff at Indiana University
katy: This journal has high quality articles.
Whisper To
Done
URL: http://www.scip.org/news/cimagazine.asp
scip.org
About SCIP
Contact Us
Education & Events
Chapters
CI Marketplace
News & Pubs
CI Newsbriefs
CI Magazine
CI Review
Surveys
Press Information
Publications Store
Job Marketplace
What is CI?
Advertising
Member Services
Members Only
CI Shopping Cart
news & publicatio
Competitive
Competitive Intelligence Mag
source for news and "how to
of CI -- provided in a format t
journalistic. All SCIP membe
Magazine. A sampling of art
presented here (beginning w
down to review past issues).
issues from the SCIP public
Use the search feature to lo
the online CI Archive for a s
categorized by subject.
List of Worlds
3-D Graphics Window
Chat Window


Visualizing Social Diffusion Patterns in 3D (Virtual Worlds)
(Börner & Penumarthy, 2003 & 2004)

VLearn 3D Vis
(Börner, Hazlewod, Jones, Lee & Penumarthy, 2003)

Temporal-spatial distribution of Conference attendees

- Conference worlds are represented by square, perspective maps, each labeled by its name.
- Worlds accessed at the beginning of the conference are placed at the bottom, worlds accessed later toward the top.
- Next to each world is a circular snapshot of the virtual venue. Short descriptions of the main sessions are added as text.
- Major jumps between worlds are visualized by transparent lines. The thickness of each line corresponds to the number of traveling users. Color coding was used to denote the chronological paths of the conference sessions.



Collaborative Spatial-Semantic Information Navigation

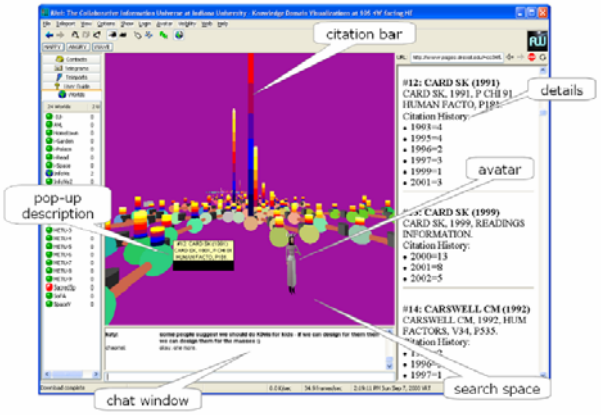


Figure 2. The user interface of the collaborative virtual environment.

Chen, Chaomei and Börner, Katy. (Feb. 2005). The Spatial-Semantic Impact of a Collaborative Information Virtual Environment on Group Dynamics. PRESENCE: Teleoperators and Viortual Environments. Special Issue on Collaborative Information Visualization Environments, 14(1): pp. 81-103.

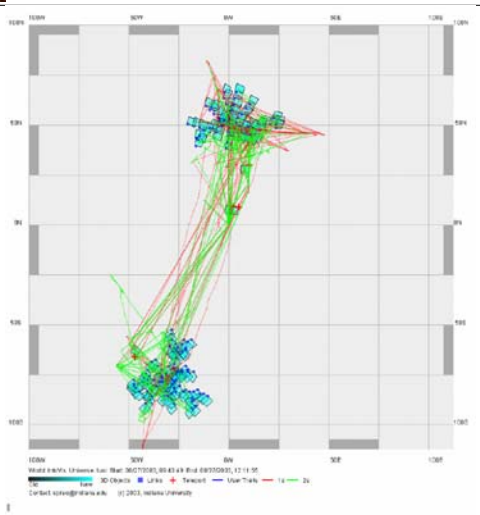


Figure 7. The trail map for Group 1.

Katy Börner: Visual Interfaces to Digital Libraries, NII Talk, Tokyo, Japan, Nov 21th, 2005.

Katy Börner: Visual Interfaces to Digital Libraries, NII Talk, Tokyo, Japan, Nov 21th, 2005.

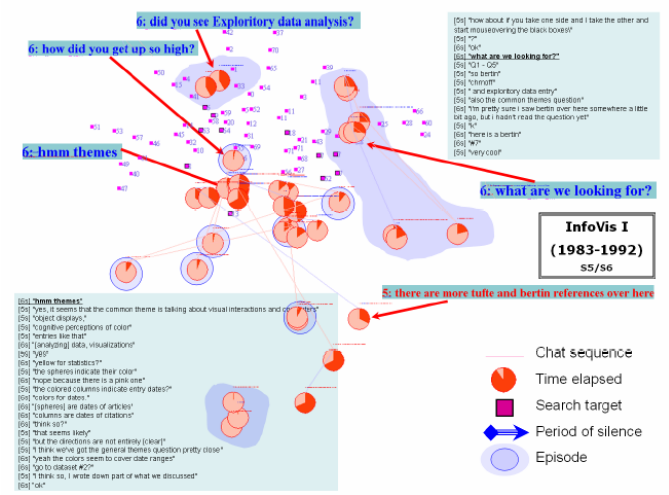


Figure 9. Episodes of collaborative search by Group 3.

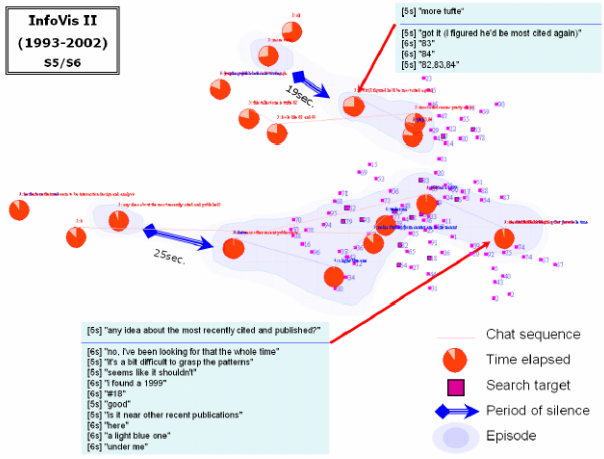


Figure 10. Episodes containing extended intervals of silence while group members being engaged in individual search.

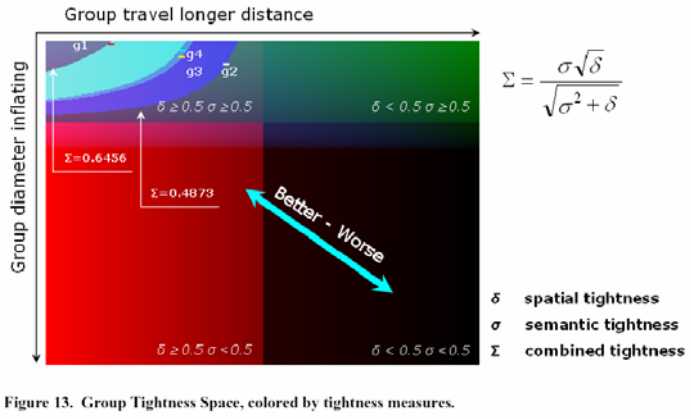


Figure 13. Group Tightness Space, colored by tightness measures.

Katy Börner: Visual Interfaces to Digital Libraries, NII Talk, Tokyo, Japan, Nov 21th, 2005.

First International Symposium on "Collaborative Information Visualization Environments" IV 2002, London, UK.

Organizers:
Katy Börner, Indiana University, USA & Raquel Navarro-Prieto, Motorola, UK

Program Committee:
C. Chen, H. Chen, T. Erickson, J. Leigh, S. Mukherjea, Y. Rogers, R. Shibasaki

Call for Papers

Information VISUALISATION IV02

For more information please consult
http://www.graphicslink.demon.co.uk/IV02/

Second International Symposium on "Collaborative Information Visualization Environments" IV 2003, London, UK.

Organizers:
Katy Börner, Indiana University, USA
Raquel Navarro-Prieto, Universitat Oberta de Catalunya, Spain

Program Committee:
C. Chen, H. Chen, T. Erickson, J. Leigh, S. Mukherjea, Y. Rogers, B. Zhu

Call for Papers

Information VISUALISATION IV03

For more information please consult
http://www.graphicslink.demon.co.uk/IV03/

PRESENCE

Special Issue on CIVEs:
A selected set of extended CIVE papers will be published in a special issue of Presence, MIT Press (http://mitpress.mit.edu/pres) in April 2004. Download Call for Papers.

4. Top Ten List of Major Challenges

detailed in Borner & Chen book

1. **Theoretical Foundations.** Although principles for perception and cognition, principles for computer graphics, and principles for human-computer interaction do exist, they do not lead themselves readily in the form of design principles. Many principles are tightly coupled with particular environments and it is hard to generalize them. More often, the same fundamental problem disguises itself in different forms, which also complicates the process of putting available theories into practice. Foundation works are urgently needed.
2. **Empirical Foundations**. It is crucial to make clear what has been empirically proven to be useful and beneficial.
3. **Scalability.** Computing and data processing power is growing faster, so is the volume of the data we need to handle. Visual scalability is the capability of visualization tools to display large datasets effectively, in terms of either the number or the dimension of individual data elements.
4. **Labeling.** Displaying readable labels and selecting meaningful labels.
5. **Individual Differences.** One size can hardly fit all. Spatial ability indicates an individual's ability to recognize and handle spatial relationships of objects. Research in human-computer interaction has shown that individual differences can be the most significant factor in one's performance.

6. **Supporting Collaborative Work.** Given the individual differences we need to accommodate and the diversity of social norms in cyberspace, supporting collaborative work is a challenging in its own right.
7. **Benchmarking and Standardization.** The provision of commonly accessible and comparable test collections has been proven useful in several fields, especially test collections in information retrieval and associated text retrieval conferences (TREC).
8. **Evaluation** is needed to answer what has worked.
9. **Personalization.** Pro-active, customized, and personalized information delivery is an increasing trend in digital libraries. Visual interfaces are in a good position to organize and re-organize the way an underlying digital library is presented to a client, tailored accordingly to the client's background and access history.
10. **Modularization and standardization** of digital library services and information visualization services will save valuable resources from re-inventing wheels.

Acknowledgements

Thanks go to Helen Atkins, ISI and Eileen Fry, Indiana University for discussions concerning the Science Citation Index Expanded and the Dido Database.

The research was supported by a High Performance Network Applications grant of Indiana University.

Publications

Book

- Börner, Katy and Chen, Chaomei (Eds.) (2002). Visual Interfaces to Digital Libraries. Springer Verlag, LNCS 2539.

Edited Journals

- Börner, Katy & Navarro-Prieto, Raquel (Feb. 2005) *PRESENCE: Teleoperators and Viortual Environments*. Special Issue on Collaborative Information Visualization Environments. MIT Press, 14(1).
- Börner, Katy & Mostafa, Javed (March 2005) *International Journal on Digital Libraries*. Special Issue on Information Visualization Interfaces for Retrieval and Analysis. Springer-Verlag, 5(1).

Papers

- Chen, Chaomei and Börner, Katy. (Feb. 2005). The Spatial-Semantic Impact of a Collaborative Information Virtual Environment on Group Dynamics. *PRESENCE: Teleoperators and Virtual Environments*. Special Issue on Collaborative Information Visualization Environments, 14(1): pp. 81-103.
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